UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Summary Review of Monthly Reports*
for
SOIL CONSERVATION SERVICE RESEARCH**
OCTOBER 1949

EROSION CONTROL PRACTICES DIVISION

Soil Structure Studies - C. S. Slater, Beltsville, Maryland.- "Three different soils were set up in 18 tubs last spring in an experiment that was carried throughout the summer to determine the degree of slumping that would occur from excessive wetting in soils having different water-stabilities. The soils received but little natural rainfall and were wetted at each irrigation to tensions of 32, 16, 8, 4, 2 and 0 centimeters at the soil surface. After standing overnight, all soils were allowed to drain freely to 36 centimeters of tension.

"The soils used had water-stabilities of 94, 88, and 40 percent, respectively.

"Results were negative. No slumping occurred that could be related to wetness in any of the soils. A water-stability of 40% was adequate to maintain a good structure under the conditions of the experiment.

"Some slumping did occur that was related to kind of soil.

Soil	Water-Stability	Volume weight		
		Initial	Final	Increase
	%	gm/cc	gm/cc	%
Christiana silt loam 1-3"	94.3	1.133	1.200	5.0
" " " 3-5"	87.6	1.250	1.290	3.2
Hyattsville silt loam 1-5"	39.5	1.233	1.234	0.1

"The increase in volume weight of the Christiana silt loam from the 1-3 inch depth no doubt reflects the low degree of compaction this soil had at the beginning of the test. However, the Christiana silt loam from the 3-5 inch depth had an initial compaction higher than that of the Hyattsville silt loam. Even so, it slumped more than the Hyattsville soil, in spite of its higher water-stability. It appears that water-stability alone is not a complete measure of the tendency of soils to lose tilth when subject to wetting. Some other factor, probably plasticity, also is involved.

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"The soils in this experiment were limed, fertilized with complete fertilizer including trace elements, and cropped to corn. Yields showed no relation to the variations in tension that were temporarily imposed on the soil. Since structure was maintained at about the same level within each series, corn growth was similar at all degrees of wetness.

"The greatest difference in yield was obtained between the Christiana soils of 1-3 inches and 3-5 inches depth. This fact is important in that it gives evidence (in keeping with the water-stability analyses) of a marked striation in soil quality at shallow depths. The two soils were taken from the same location in an idle field thathad been plowed and cultivated about 8 years ago, at which time all the soil to a depth of 7 inches must have been essentially homogeneous. Relative yields are given in the following table:

Soil	Relative Yields	
	Grain	Fodder
Christiana silt loam 1-3"	100	100
Christiana silt loam 3-5"	79	97
Hyattsville silt loam 1-5"	97	95

Soil Permeability Studies - C. A. Van Doren, Urbana, Illinois.- "A paper entitled 'Permeability Studies on Some Illinois Soils' was presented at the annual meeting of the Soil Science Society of America on October 27. The authors are C. A. Van Doren and A. A. Klingebiel, State Soil Scientist, Soil Conservation Service.

"Seventeen soils have been classified into permeability classes based on percolation rates in inches per hour and on percent pores drained. These soils range from very slow to rapid in permeability. There was a close relationship between percolation rates and pores drained. Methods used in permeability studies do not give absolute values, but results give an indication of general soil permeability classes. Permeability classification checks closely with tillability of soils studied.

"Surface samples from plots receiving soil treatment since 1912 had higher percolation rates and higher percentage of pores drained than untreated plots. Soil treatment consisted of limestone, rock phosphate, and potash.

Table1.--Effect of Treatment on Permeability, Pores Drained on Two Illinois Soils.

Soil Type and Soil Treatment 1/	Depth Inches	Percolation Inches/Hour	Pores Drained Percent
Cisne Silt Loam:			
Untreated	0-3	0.10	2.74
(Check)	7-10	0.36	5.09
Cisne Silt Loam:			
Full treatment	0-3	0.30	3.17
(RLPK)	7-10	0.80	6.09
Elliott Silt Loam:			
Untreated	0-3	2.40	1.95
(Check)	8-11	0.82	4.27
Elliott Silt Loam:			
Full treatment	0-3	3.06	3.65
(RLPK)	8-11	3.04	4.37

1/ Full treatment included applications of limestone (l), rock phosphate (P), potash (k). Residues (R) were returned to all plots."

New Tobacco Rotation Experiment Shows Soil Loss Differences - T. L. Copley, Raleigh, N. C.-"Soil losses during June, July, August and September, from several treatments are shown in the table below. This covers our critical summer period, together with the winter cover seeding period in September. Although this is the first year of the revised experiment, some interesting trends are noted: (1) All winter covers provide some protection during the summer, and late spring turning materially increases the beneficial effects. (2) The mulch balk method reduced erosion to less than one half that of all other treatments. Here, the winter cover residue was left undisturbed in a balk middle until the last cultivation of the tobacco when it was plowed out and the mulch scattered in the row middle. While this method looks promising from the erosion angle, it is possible that it may adversely affect tobacco yields unless moisture competition can be avoided. This must be watched closely. (3) There was a marked increase in erosion during September with the land preparation and seeding of winter covers. On the check plot, however, where no winter cover was seeded, the undisturbed volunteer summer grass furnished almost complete protection. This erosion during the seeding period tended to offset some of the summer benefits of the winter cover. It suggests that we need to watch the vulnerability of the land at that time.

Soil Losses from Tobacco, Following Different Winter Covers - 1949
(Four Replicates)

Winter Cover Preceding Tobacco	JUNE	JULY	AUGUST	SEPT.	Total for Period JUNE-AUG.	Total for Period JUNE-SEPT.
	Tons/Ac.	Tons/Ac.	Tons/Ac.	Tons/ac.	Tons/Ac.	Tons/Ac.
No cover	3.09	1.62	.56	.06*	5.27	5.33
Rye Grass	3.18	1.48	.26	1.07	4.92	5.99
Rye, turned early	2.82	1.62	.40	1.07	4.84	5.91
Rye, turned late	2.51	1.11	.33	1.00	3.95	4.95
Rye-vetch, turned late	2.58	1.04	.52	.96	4.14	5.10
Rye-Mulch balk	.76	.54	.23	.74	1.53	2.27

* From 2 replicates only. Other two replicates plowed by mistake when other winter covers were seeded.

Comparison of Ridged and Flat Cultivation of Tobacco - C. S. Britt, Beltsville, Maryland.-"Tobacco studies in 1948 gave a marked difference favoring ridged rows when compared with flat rows on the same grade. Three fields representing wide differences in soil and past erosion were used. Each field contained three replications of ridged and flat cultivated tobacco. In each of the nine sets of replications, the ridge row cultivation gave higher crop values than flat cultivation. In all but one replication (replication 2, field 3A) the crop yields were higher on the ridged rows than on the flat rows. In this case the tobacco quality was much better on the ridged rows. In another replication (replication 1, field 3B) the crop value was slightly higher on the flat than on the ridged tobacco. This difference was caused by an exceptionally heavy growth on the ridges with some 'second growth' in the tobacco. The total crop value was much higher on the ridged tobacco as shown in the following table.

"The growing season was unusually wet during the early part of the season and very dry during the last part of the season. Under these conditions the tobacco cultivated flat showed some damage about thirty days after planting when excess water caused some firing and wilting in the tobacco.

"All conditions other than method of cultivation were the same in all plots.

Comparison of Ridged and Flat Cultivation of Tobacco with Controlled Row Grades, Beltsville, Maryland, 1948

Field 3A. Thin soil severely eroded by 7 crops cultivated with slope (1940 to 1946), summer fallow 1947, tobacco grown on 1% grade rows 1948.

Replication No.	Tobacco Yield Lbs/Acre		Tobacco Quality Cents/Pound		Crop Value Dollars/Acre	
	Ridged	Flat	Ridged	Flat	Ridged	Flat
1	911.29	741.38	37.5	30.3	341.29	224.83
2	716.67	750.00	37.6	34.2	269.67	256.21
3	1194.44	550.00	38.4	33.8	458.15	186.00
Field Average	940.80	680.46	37.9	32.7	356.37	222.35
Field 3B. Thin to medium soil protected by 1% grade during 7 previous crops (1940-1946)--Otherwise same as 3A.						
1	1540.32	1075.00	33.6	37.0	517.42	397.67
2	1187.50	1028.85	37.9	34.8	449.44	358.08
3	1236.11	972.22	43.2	41.9	533.33	407.78
Field Average	1321.31	1025.36	37.9	37.8	500.06	387.84
Field 3C. Medium to deep soil eroded by 7 crops cultivated with slope (1940-1946) -- otherwise same as 3A.						
1	1444.44	1259.26	39.3	35.9	568.15	451.85
2	1370.69	1267.86	37.2	32.7	509.31	415.00
3	1080.36	920.21	40.6	36.3	438.57	334.26
Field Average	1298.50	1149.11	38.9	34.8	505.34	400.37
Average of the three fields	1186.87	951.64	38.3	35.4	453.92	336.85

	Increases due to ridging		
Field 3A	260.34	5.2	134.02
Field 3B	295.95	0.1	112.22
Field 3C	149.39	4.1	104.97
All fields	235.23	2.9	117.07

Pasture Studies - O. K. Barnes, Laramie, Wyoming.-"A preliminary summary of the 1949 results from the seeded pastures at Archer shows production down for the year. Native range this year carried about 95 per cent of the seven-year average whereas the seeded pastures as a whole carried only 62 per cent as many animals as compared to their seven-year average.

"The precipitation during this period is shown in table 1 for the three spring months and the total for the year. Table 2 summarizes the grazing rates and lamb gains from the eight seeded pastures and from native range for the period 1942 through 1949.

Table 1.--Inches of Precipitation at Archer Field Station.

	1942	1943	1944	1945	1946	1947	1948	1949	Ave.
April-May-June	10.30	6.39	8.06	8.36	5.33	9.99	4.50	9.72	7.83
Annual	21.75	13.30	14.48	16.41	18.05	19.11	10.81	20.08*	

* Precipitation through October 1949.

"This past season was near the most favorable year for growth of cool season grasses. The precipitation approaches the high of 1942. Even with this favorable moisture situation, production from these seeded pastures was very low, indicating a need for renovation of some type or the application of fertilizer.

"Although production is falling, the eight-year average shows all of these pastures producing about double that for native range. If lamb is figured at 10 cents per pound, an acre of crested wheat, for example, returned $71.20 for the eight years as compared to $23.20 from an acre of native range. This comparison is made to native range since that is the most common source of grazing. Comparisons can be made to other crops from these data.

"The eight-year average showed crested wheatgrass the best early spring pasture of those tested. Little difference exists between the fairway and standard strains of crested wheatgrass. Western wheatgrass has made a good showing as a late spring and early summer pasture. At this season it has been more palatable than crested wheatgrass. The grazing capacity of western wheat has been about 25 per cent less than the total from crested wheat. Russian wildrye has been outstanding from a palatability standpoint. It appears that if seed ever becomes plentiful for this species that it will have an important place particularly for fall and winter grazing. From the standpoint of total production, Russian wildrye has carried about 30 per cent less than crested wheatgrass. The decline in production on western wheat and Russian wildrye was greater this year than for crested wheatgrass, both falling below the native range production. The grass mixture of crested wheatgrass, Russian wildrye and western wheat has averaged about 10 per cent less than crested wheatgrass alone. This has been due primarily to palatability differences, the crested wheatgrass rating lower and being left until it becomes somewhat coarse thus resulting in less uniform utilization than occurs on the pure seedings. The 35-inch row seedings of crested wheatgrass with and without alfalfa cannot be compared to the other pastures without some qualifications. However, these two are comparable and the differences can be attributed to the legume. Over the eight-year period the grass-legume combination has carried approximately 30 per cent more animals than the crested wheatgrass alone. The blue grama-buffalo grass pasture has deteriorated greatly during this eight-year period. The blue grama has been largely replaced by buffalo grass, cheatgrass and volunteer crested wheatgrass. The average grazing capacity of this pasture has been about 80 per cent higher than the native range but the animal gains average only 20 per cent higher than the native range. On the whole, this combination of warm season species has been unsatisfactory. The low palatability of the buffalo grass resulted in consistent and excessive overuse of the blue grama.

Table II.

Summary of Grazing Rates and Lamb Gains from Seeded Pastures at the Archer Field Station - 1942-1949.

Year	Cr. Wheat Standard		Cr. Wheat Fairway		Cr. Wheat in 35" rows		Cr. Wheat & Alfalfa 35" rows		Western Wheat		Russian Wildrye		Grass Mixture		Blue Grama Buffalo		Native Range	
	Sheep Days Per Acre	Lamb Gain Per Acre	Sheep Days Per Acre	Lamb Gain Per Acre	Sheep Days Per Acre	Lamb Gain Per Acre	Sheep Days Per Acre	Lamb Gain Per Acre	Sheep Days Per Acre	Lamb Gain Per Acre	Sheep Days Per Acre	Lamb Gain Per Acre	Sheep Days Per Acre	Lamb Gain Per Acre	Sheep Days Per Acre	Lamb Gain Per Acre	Sheep Days Per Acre	Lamb Gain
1942	228	143	228	149	127	56	172	134	178	105	200	102	195	124	187	101	71	26
1943	196	125	196	123	141	69	157	76	154	77	127	65	152	87	145	62	69	42
1944	173	108	173	107	67	--	169	--	128	73	114	53	158	94	148	37	59	29
1945	173	90	173	90	173	89	211	125	139	71	139	59	169	76	135	17	61	30
1946	58	35	56	22	119	46	127	71	49	27	62	31	58	33	54	18	47	20
1947	160	97	142	88	147	77	233	121	132	72	87	47	139	82	92	13	70	30
1948	66	53	66	46	91	48	119	67	54	35	53	25	62	41	38	11	50	26
1949	90	62	90	61	106	63	122	79	54	34	53	20	86	56	68	24	56	30
Ave.	143	89	141	86	121	64	164	96	111	62	104	50	127	74	108	35	60	29.

Kudzu Pastures - B. H. Hendrickson, Watkinsville, Ga.,"Kudzu on poor land is not much of a grazing crop by most pasture standards. It has required about 3 acres per cow on the average for full feed for a beef cow unit for 4 months, kudzu pastures being closed April 15 to June 15 to allow re-establishment of stand. There is however no economical substitute for kudzu in the Southern Piedmont for protection and fitting poor land for 'Good Land' pasture crops to follow.

"Preliminary trials under grazing conditions in sizable pastures have indicated that supplemental winter annual grazing crops can be established in kudzu pastures without seriously affecting the next seasons kudzu recovery. Indications are that kudzu may be totally replaced by such combinations as perennial fescue - ladino clover. This practice appears to be most suitable in kudzu field meadow-outlets where kudzu is a mis-fit vegetative cover."

Stubble Mulch Studies - Winter Legumes - C. J. Whitfield, Amarillo, Texas.-"Austrian winter peas and hairy vetch were drilled in Sudan grass stubble at rates of 40 and 30 pounds per acre respectively on October 7 and November 15, 1948. The November planting date proved to be too late and unsatisfactory stands were obtained. The October planting resulted in satisfactory stands which made a good growth during the wet spring of 1949 and were subtilled on May 30. The following information was obtained concerning the above-ground portion of the crop at that time:

Crop	Dry Weight Lbs. Per acre	Percent Nitrogen	Nitrogen Lbs. Per Acre
Austrian winter peas	2490	2.93	73
Hairy vetch	2297	3.63	83

"The land was planted to wheat on September 9, having received a total of 4 tillage operations, three times by subtillage and finally, with the rod weeder. Soil samples taken to a depth of four feet on September 22 revealed the land in Austrian winter peas and hairy vetch to have 2.44 and 4.13 inches of available water respectively, compared to a value for the check of 6.35 inches. Inches of water lost for each pound of nitrogen contained in the tops was, therefore, .054 for Austrian winter peas and .027 for hairy vetch. It appears that, from the standpoint of moisture conservation, hairy vetch would be the more desirable of the two legumes for soil improvement purposes. Approximately 346 pounds water were lost for each pound dry matter produced by winter peas and 213 pounds for vetch."

Stubble Mulch Favorable in Dry Season - Hugh C. McKay, St. Anthony, Idaho.-"The summer of 1949 was noted for the low temperatures and extreme dryness during the growing season. The two frosts the last week of June completely killed the winter wheat and reduced the yield of spring grain by about 50%. The lack of rainfall from the first week of June to the last week of August helped reduce the yield of spring grain. Some of the tillage plots on the station seeded to winter wheat, winter killed and it was necessary to reseed to spring grain. While the yields of spring grain were greatly reduced there was considerable difference in the yields from the various tillage practices and are given in the following table.

Yields of Spring Wheat in Bushels Per Acre from Various Tillage Practices 1949.

Tillage Practice	Stubble Utilized Bu. Per Acre	Stubble Burned Bu. Per acre
Moldboard Plow	12.0	12.1
One Way Disk	14.0	11.4
Subsurface sweep	14.4	11.1
AVERAGE	13.5	11.5
One Way Disk		
4000 lbs. straw	13.6	
2000 lbs. straw	13.8	
75 lbs. Am. Sul. Time of seeding	12.6	

"The stubble utilized plots for the one way disk and subsurface sweep showed up greener all summer long. This was probably caused by the moisture being a very critical factor this summer due to the prolonged drought.

"It has always been our feeling that during extremely dry years the stubble mulch system would show to advantage and this years data tends to bear this out."

Wind Erosion in Relation to Decline in Productiveness of High Plains Wheat Land - H. H. Finnell, Goodwell, Oklahoma.-"At last I have begun to get some of the answers we have found inaccessible heretofore in our studies of wind erosion. We now have proof that wind erosion of soils has affected the productive capacity of High Plains wheat lands and that it is responsible for an average loss of 2.20 bushels per acre in continuous wheat culture, 4.29 bushels per acre on summer fallowed land. It is also strongly borne out that the first fruits of erosion during the cultivated life of a field was 4-1/2 times as destructive as later soil removals. This is in keeping with the changing color of dust storms as the dust bowl years went by and is also supported by analysis of dust collected at different stages of the dust bowl cycle. Erosion reduced the actual yield .52 bushels per acre per year for the first 4 years, compared to .11 bushels per acre per year for the next 21 years.

"These determinations, along with the observed fact that erosion has lowered the ceiling of fallow land production in keeping with the annual rate of production loss, indicate that the land capability has actually been affected in such a way as to forecast a step-by-step loss of the productive soil resources of the plains if erosion be permitted to continue in substantially the same effect as it has done since the High Plains began to be put in cultivation.

"Along with the decline of productivity chargeable to erosion removals of soil has gone a lesser but more steady decline due to crop removals of fertility from the land. The decline of productivity due to erosion was five times as much as that due to crop removals during the first four years of erosion. It was 1-1/2 times as much during the next 21 years of cultivation. The total decline in productivity of land which has been in cultivation 15 years or more due to both causes amounts to 7.01 bushels of wheat per acre."

Partridge Pea Seeded with Oats in an Oats- Corn Rotation Reseeded and Maintained Itself Under Stubble Mulch Practice - F. L. Duley, Lincoln, Nebraska.-"The effect of some annual legumes when used in a stubble mulch system with corn is being measured this year. In one test just completed preliminary weights show that corn following partridge peas gave a yield of 65 bu. per acre. The no-legume plot yielded 43. This increase of 22 bushels has been obtained with a minimum of effort. The partridge peas were seeded in oats in 1945. A rotation of oats and corn has been followed since that time, using the stubble mulch system. Whenever the land is in oats and peas volunteer and give a thick stand and good growth in the fall fater the oats are removed. The beneficial effects of the legume show up on corn the following year.

"The other legumes, lespedeza, annual sweetclover, vetch, and biennial sweetclover also seeded in 1945 have disappeared from this land and no longer come as volunteer crops in the small grain.

"This work with legumes in a stubble mulch system is attracting considerable attention among farmers. So much so that the supervisors in the Pierce County district have offered to provide a farm for expansion of our studies. Shortage of funds for Soil Conservation Service Research may make it impossible to take full advantage of this offer. However, a plan is being considered in cooperation with Soil Conservation operations and the Department of Agronomy, of the Experiment Station, whereby some work can be done. It would seem most unfortunate if local interest such asshown by these District Supervisors could not be utilized to advance our research program on some of the vital problems needed in these areas.

Infiltration Tests on Land with Heavy Subsoils - "Mr. Paul Fischback, a graduate student, is continuing his infiltration tests on land with heavy subsoils. He is attempting to determine the rate at which water will pass through these heavy layers. This information would be particularly valuable now, since it is desired to irrigate many of our relatively level prairie soils that have developed claypans, or at least heavy clay subsoils. The results to date indicate the possibility of getting water through these heavy layers in sufficient quantities to allow aprinkler irrigation to proceed there in a satisfactory manner."

Effects of Irrigation and Rotation on Potato Yield - O. R. Neal, New Brunswick, New Jersey.-"Potato yields from the rotation plots on the vegetable research farm showed a marked response to irrigation and a considerable response to rotation treatment during 1949. The need for irrigation was much greater during the past summer than it has been in any previous season during operation of the plots. Seven applications with approximately 1 inch of water per application were required during the growth of the crop. During June when temperatures were only moderately high and when the plants had not attained full size, irrigation was necessary at intervals of from 9 to 12 days. Later in the season when temperatures were higher and the plants larger, an inch of water was required at intervals of from 5 to 7 days.

"The cropping systems followed in this study include continuous potatoes, a 2-year rotation of potatoes and wheat, and a 3-year rotation of potatoes, wheat and clover. All treatments appear in duplicate with and without supplemental irrigation. The 1949 yields are shown in Table 1.

Table 1.--Yields from Potato Rotation Plost, 1949 - Bu./Ac.

Treatment	No. 1 size	No. 2 size	Total
	Irrigated		
Continuous Potatoes	275	45	333
2-Year rotation	356	42	407
3-Year rotation	348	41	399
	Not Irrigated		
Continuous potatoes	111	48	175
2-Year rotation	120	57	192
3-Year rotation	138	51	204

"All treatments showed a large increase in yield with irrigation as would be expected under conditions of deficient rainfall.

"Within either the irrigated or the unirrigated series, the yield was greater from rotated areas than from continuously cultivated areas. The response to irrigation was relatively greater on the rotated plots. The yield increase of No. 1 size due to irrigation amounted to 164 Bu./A. from continuously cultivated areas and varied from 220 to 236 Bu./A. from rotated areas. These results are in agreement with results from other studies which show that soil-conserving rotations usually increase the acre yields of cultivated crops included in the rotation."

Hairy Vetch as Winter Cover Crop Improved Cotton Yield - T. N. Jones, State College, Mississippi.-"The cotton was harvested on the soil erosion plots during the month of October. It will be noted from the yield table below that the odd numbered plots have higher yields than their mater plot. This is due to vetch as a winter cover crop. The vetch not only increases the yield but reduces soil and water loss throughout the year.

"Hairy vetch was seeded on the odd numbered plots in early October.

Cotton Yield - Erosion Plots 1949

Plot No.	Yield Seed Cotton Per Acre	Plot No.	Yield Seed Cotton Per Acre
1	1560	6	1920
2	1520	7	2280
3	1800	8	1920
4	1520	9	2240
5	2080	10	1600

Corn and Soybean Yields in Relation to Rotations and Fertilizer - D. D. Smith, Columbia, Missouri.-"Runoff and soil loss under corn and soybeans were low during the 1949 crop period. They have been lower during only two of the nine years of records. Yields of corn and soybeans were nearly equal to last year's record high. Thos yields available at present are as follows:

Crop	Rotation	Yield in Bu./acre 1949	1941-46 Ave.
Corn	C-O (no treatment)	20	26
Corn	C-W-SwCl (hay)	71	29
Corn	C-W-M	83	32
Corn	C-W-M-M	107	33
Corn	C-W-M-M-M-M	104	32
Corn	C-SB-W-M	97	29
Soybeans (7"rows)	C-SB-W-M	36	--
Soybeans (42" rows)	C-SB-W-M	30	--
Soybeans (7" rows)	SB-R-M	36	--
Soybeans (7" rows)	SB-O & SwCl	29	--

"The effect of prolonged cropping in a system without grasses, legumes and fertilizer is shown by the near failure of the corn in the corn-oats rotation. During the first 6 years of the study, the corn in this rotation yielded only 7 bushels less than the average for the unfertilized corn in the soil conserving rotations. With the addition of needed soil nutrients to the corn in the soil conserving rotations, the yields for the past two years have trebled their previous averages.

"The fertilized corn plots received 300 lbs/acre of 5-10-10 starter, 300 lbs/acre ammonium nitrate, and 1000 lbs/acre rock phosphate. They have also been limed 5 tons per acre. Cost of the treatment, with rock phosphate and lime costs pro-rated on annual basis, amounted to $22 per acre for the year. Yield increases resulting from the effects of cropping systems combined with this treatment ranged from 51 to 87 bushels of corn per acre.

Effect of Supplemental Irrigation on Yields of Corn and Soybeans -"Mr. Whitt reports the following on the supplemental irrigation. 'Supplemental water accounted for a 10-bushel yield increase per acre in one instance, and 49 bushels in another comparison this year. No yield increase resulted from irrigating soybeans.

'Yields for 1949 were as follows:

Treatment	Yield in bushels per acre		
	Corn		Soybeans
	Block A	Block C	Block E
Water only	54.9	89.4	25.7
Fertilizer only	95.0	103.1	24.7
Water and fertilizer	105.7	152.2	24.8

"The soil on Block C is higher in fertility than that on Block A, it having been in cultivation and receiving soil treatment several years before this study was begun. This accounts for the higher yield level on Block C. Fertilized corn received fertilizer adequate for producing 125 bushels per acre according to soil tests. The irrigated plots received 2 one-inch irrigations."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio,-"October rainfall of 0.90 inch was the seventh lowest in 50 years of Weather Bureau records in this area. Soil moisture is very low. Percolation from the 8-foot lysimeters has not yet started.

"Mr. Schiff reports that a recent discussion of our hydrologic work with flood control engineers in Region III at Coshocton revealed their need for infiltration data. An infiltration report was, therefore, compiled to include the following:

1. A brief discussion of the derivation of infiltration curves for small natural watersheds.

2. Infiltration curves for various crops upon two hydrologically different soil types at various initial soil-moisture contents.

3. Estimations of the initial soil-moisture content based on antecedent rainfall and soil-moisture depletion.

"Copies of this report have been furnished to both the Indianapolis and Milwaukee flood control offices and also submitted to Washington for publication."

Hydrologic Studies - R. W. Baird, Blacklands Experimental Watershed, Waco, Texas.-"At the Blacklands Experimental Watershed for the month of October the rainfall totaled 4.45 inches at the central meteorological station. The normal for October is 2.59 inches. Yields of corn were much better than normal, but the yield of cotton has been relatively low. This low yield of cotton on the areas with conservation practices was largely due to leaf spot which damaged the crop during the wet weather of July and early August. There was considerable damage on all areas by root rot, but this damage was much more severe on those areas without conservation practices. The cotton yield for 1949 is about two-thirds that of 1947 and 1948 on the areas with conservation practices and much less than this on untreated areas. It is hoped that a complete report on crop yields can be assembled during the month of November.

"The rains of October caused no runoff from any of the field areas owing to the dry weather of late August and September.

"Cattle turned on a Bluestem meadow for a short grazing period soon located the areas on which different rates of nitrate fertilizer had been applied last spring. The fertilized plots were grazed closely; whereas the unfertilized plots and adjoining areas were very lightly grazed. In addition to an increase in the yield of hay which was harvested in July, the late summer growth furnished a palatable crop of forage for a short grazing period in the fall. Harvested hay yields from the different rates of nitrate per acre were as follows: 32 pounds of nitrogen - 1.19 tons; 64 pounds of nitrogen - 1.86 tons; and 96 pounds of nitrogen - 2.20 tons of air dry hay per acre in comparison to only 0.62 of a ton on the check areas without the application of nitrogen

"In October the soil moisture in comparison to last season was much higher, though more rain is needed before field capacities are satisfied. Recent samples after the October rains showed the areas with (Y) or without (W) conservation practices to have about the same percentage of moisture with similar cropping systems. There was a slight difference in favor of the W area, indicating that the higher crop yields on the Y area had utilized the moisture conserved early in the season in increased production."

Hydrologic Studies - John A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebraska.-Only one rain of any consequence occurred during the month. This rain, on October 9-10, varied from 2.5 to 3.3 inches over the watershed with maximum intensities ranging from 3 to 5 inches per hour. Waterways on watershed W-5, which were seeded in September were severely damaged by gully erosion and washing of the seed. The waterways were patched up and reseeded again on October 13-17. Grass stands are not very encouraging. The parts that were not seeded were badly crusted, which hindered germination and the parts that were reseeded were probably planted too late in the season."

"The following average peak rates of runoff were the results of the rain of October 9-10:

Maximum Average Peak Rates of Runoff - In Inches per Hour From Approximately 4-acre Watersheds, Under Different Land Use Practices. October 9-10, 1949

Total Rainfall - 2.5 to 3.3 inches.
Maximum Intensities - 3 to 5 inches per hour.

	Corn	Oats	Wheat
Straight row	2.96	2.65	2.02
Contoured	1.31	1.92	1.64
Subtilled	2.94	2.49	2.30

Native grass meadow	.31 inch per hour
Native grass pasture	1.21 inches per hour

Maximum Average Peak Rates of Runoff - in Inches per Hour

Pasture Plots Under Various Treatment
October 9-10, 1949

Treatment	Peak Rates--Inches per hour
Untreated, check	.73
Renovated with eccentric disk	.50
Furrowed, 12 - 16', horizontal spacing	.06
Furrowed, about 5' horizontal spacing	.05

Hydrologic Studies - R. B. Hickok, Lafayette, Ind.-"The drought of the previous 3 months was broken by over 8 inches of rain in October, 300 percent of the 'normal' for this vicinity. A total of 3 inches fell within a 24-hour period on October 11. However, the soil on the experimental watersheds was in a condition to infilter and store a very great amount of water and there was little runoff from the October 11 storm or from subsequent storms, even though 1.70 inches fell after the 3-inch rain on the 11th. October 1949 appears to have been a very rare month, hydrologically.

"Corn yields were sample harvested and the following table summarized the results:

Table 1.--Corn yields, experimental watersheds, Purdue-Throckmorton Farm, Lafayette, Ind.

Treatment*	Wsd.	Yield est. Bu/A** Mean	Std. error
Conservation	14	125	1.9
	18	133	2.5
	Av.	129	4.0
Prevailing	15	77	1.7
	10	82	2.9
	Av.	80	2.5
Treatment difference		49	Highly significant

*Conservation treatment included contour cultivation, approximately 6 T. manure and 1,000 lbs. 8-8-8 fertilizer plowed under, w/150 lbs. of 2-12-6 in rows, following Alf.-R.Cl-Als - T meadow (1 yr.) Prevailing treated corn was straight rowed w/150 lbs. of 2-12-6 in rows, following R.Cl. - T meadow (1 yr.)

**Samples 7'x7' at 50'x50' intervals, corrected to 17-1/2% moisture.

"This was the 7th year of differential treatment and the 3d crop of corn from these same watersheds since the experiments began. In spite of a season less favorable than probably either 1942 or 1945 when these watersheds have previously been in corn the yields of both the conservation and the prevailing treated watersheds, and the yield difference between the treatments, substantially exceeded those of the previous years from these watersheds. This strongly indicates continued accumulative effect of the conservation treatment on the corn yields. (The prevailing treatment also represents improvement over earlier practices on this farm and this year's average corn yields from prevailing treated watersheds was the highest for this set of watersheds since the beginning of the experiment.)

"High rainfall early in the year (the calendar year's accumulation never fell below the upper probable limit, 95 percent level, of the 'normal') provided favorable soil-moisture conditions well into the period of deficient rainfall, beginning in July and worsening over the rest of the corn growing period. The effect of the 3 months' drought on the yields was consequently unsually minimized, although almost uniformly undeveloped ear tips indicated that the yields were reduced below what they might have been with more favorable rainfall distribution. However, it seems significant that, with no substantial difference in available water during the corn growing period, this year's corn yields pushed the 7-year average for the conservation treated watersheds up 6 bushels per acre compared with a 1 bushel increase in average yields for the prevailing treated watersheds.

"This year's hay yields from the experimental watersheds were included in our June report. Chemical analyses of the hay were made by the analytical section of Agronomy Department of the Purdue Station. The data on net compositions of the mixed hay are important to obtain a record of net removal of soil nutrients from the watersheds by crops and erosion, compared with fertilizer replacements under the conservation and prevailing farming systems. However, from the standpoint of comparative feeding values of hay grown under the two treatments, the following comparisons of the compositions of red clover and timothy extracted from the samples of mixed hay are more indicative than the net compositions of the two hays with different species included in their mixtures:

Table 2.--Comparative chemical compositions of red clover and timothy from hay on experimental watersheds, Purdue-Throckmorton Farm, Lafayette, Ind. 1949

		% of wt., oven dried (70°C)				
Species	Treatment	N	P_2O_5	K_2O	Ca	Mg.
Red clover	Conservation	2.30	5.51	1.84	1.44	0.22
	Prevailing	2.48	4.35	1.36	1.75	.28
	Ratio C/P	.93	1.27	1.35	.82	.78
Timothy	Conservation	1.34	6.09	2.72	.12	.05
	Prevailing	1.17	4.35	2.12	.21	.06
	Ratio C/P	1.15	1.40	1.28	.57	.83

"The following report, by Mr. E. R. Baugh of the Experiment Station, summarizes the results of a field test on the Throckmorton this past season with corn for which the seedbed was prepared from a heavy growth clover-timothy sod with a heavy spring tooth field cultivator with horizontal sweep wings attached above the the 'bull-tongue' points. This was the second year of experimental use of this equipment for preparing a mulched seedbed for corn. The results to date have been very encouraging. The meadow residues have been mixed into the upper few inches of soil with a substantial part remaining near the surface. The soil surface has remained comparatively open and loose throughout the corn growing seasons in a condition judged to be conducive to high intake of rainfall and little erosion. The control of weeds has been comparatively easy and the corn yields have been high:

'The spring tooth field cultivator was used to prepare the seedbed for corn on one watershed and an area adjoining the watershed in 1949. This watershed has previously been handled as a prevailing practice watershed since 1942.

'The seedbed for corn in 1949 was prepared by using a large spring tooth field cultivator with small sweeps attached to each spring tooth. The teeth were spaced so that they passed through the soil at about 15-inch intervals.

'On May 3-4, watershed and adjoining area were worked to about 5-inch depth with field cultivator and a light disking was done immediately afterwards. On may 15 the area was tilled to about a 9-inch depth with the field cultivator. A total of 700 pounds 8-8-8 fertilizer was applied in bands 8 inches deep and 24 inches apart on May 17. The ordinary disk was then used to mix the residue through the surface 3 inches of soil and the watershed was planted on May 28 with 200 pounds 3-12-12 as starter fertilizer.

'The corn was cultivated <u>one</u> time with a conventional cultivating equipment.

'The area can be divided into three major groups for comparison of yield which are:

1. Seedbed prepared with spring tooth field cultivator. 700 lbs. 8-8-8 fertilizer deep and 200 lbs. 3-12-12 as starter.

2. Seedbed prepared with spring tooth field cultivator 200 lbs. 3-12-12 fertilizer as starter only.

3. Seedbed prepared by ordinary plow. 200 lbs. 3-12-12 fertilizer as starter only.

'On August 5 the corn was tested for nitrogen and showed that nitrogen was low on all three of the areas.

'The yield for the three areas was:

1. 124 bushels per acre (Spring tooth field cultivator and fertilizer)

2. 117 bushels per acre. Spring tooth field cultivator (Starter fertilizer only)

3. 117 bushels per acre. Ordinary plow. (Starter fertilizer only)

'This indicates that this type of implement can be used for preparing the seedbed for corn without a significant reduction in yield.'"

Hydrologic Studies - Geo. Crabb, Jr., East Lansing, Mich.-"Precipitation for the month of October, as measured by the USWB type of nonrecording rain gage, amounted to 2.45 inches at the cultivated watersheds, 1.87 inches at the wooded watersheds, and 2.35 inches at the stubble-mulch plots. These amounts are approximately 99 percent, 76 percent, and 95 percent of the 50-year average October precipitation of 2.47 inches. October precipitation can be expected to equal or exceed 2.45 inches once in 2.2 years. Cumulative rainfall for the year amounts to 28.87 inches, or 118 percent of the 24.41-inch normal. There were no runoffs during the month. A trace of snow fell on October 31. In 1948, the first snow (a trace) came November 10.

"Because of the extreme interest aroused by recent 'in-service' reports of the cover management-irrigation-fertilization program followed by the Wark orchards, another visit was paid to these orchards October 27, which are located 3 miles north of South Haven, by a party consisting of State Conservator E. C. Sackrider, District Conservationists W. R. O'Brien and G. E. Springer, Work Unit Technician Charles Mann, Mr. Keets Vining, formerly of the Agricultural Extension Service, Mr. Ed Longnecker, Michigan State College Soils Extension Specialist, the project supervisor, and several farmer-cooperators from the Northwestern Michigan Area. It appears that Mr. Wark's program has increased yields and quality to a higher level than ever before. Although his costs have been very high, he feels that they are feasible because of increased production. Use of the 'culti-cutter' in cover management seems to be productive of very satisfactory results in that it increases infiltration rates of the soil through its 'pocketing' effect, while making dense and continuous vegetative cover possible at a stunted level. This implement will probably receive further trial in northwestern Michigan cherry orchards during the coming year. It is felt that with the addition of a water-weighing system and a reduction in cost this implement, or one using a chisel-type cutter bar in a similar manner, may fill a long-felt need in cover management under orchard conditions.

"On October 15 a preliminary report was released for 'in-service' use on the soil moisture studies now under way in southwest Michigan. This report detailed the history of the study, the present results, and the plans for continuation of the study. The field study has been temporarily discontinued because of the approach of inclement weather, but it is expected to be resumed and expanded next spring.

"Also during the month, copies were received of reprints of the paper prepared in collaboration with Professor S. L. Wittwer, Department of Horticulture, Michigan State College, on 'Effect of Fruit Setting Treatment, Variety and Solar Radiation on Yield and Fruit Size of Greenhouse Tomatoes.' This paper is a part of the Proceedings of the American Society for Horticultural Science, Vol. 53, 1949, and was delivered at the Society meeting in May 1949.

Hydrologic Studies - J. F. Thornton, Auburn, Ala.-"The October rainfall of 2.31 inches represents 86 percent of the 68-year-average rainfall of 2.67 inches for Auburn.

"The average rainfall for Auburn for October is the lowest for any month in the year. We still received more in October than we did in either August or September. The August rainfall was 1.50 inches. The September rainfall was 1.33 inches.

"Mr. Bowden has continued running tests on the small tilt plot. Tests that he has run so far were advanced and delayed-type rains on Norfolk and Decatur soils, each with three different initial moisture contents. On the Norfolk soil with an advanced-type rain the initial moisture content was, for each test, 1.85 percent, 5.45 percent, and 15.89 percent. With a delayed-type rain on the Norfolk soil, the initial moisture content was, for each test, 3.91 percent, 5.82 percent, and 14.30 percent. The initial moisture contents of 3.25 percent, 12.42 percent, and 23.20 percent were used on Decatur soil with an advanced-type rain; and for a delayed-type rain on Decatur soil the initial moisture contents 9.97 percent, 15.57 percent, and 21.80 percent were used.

"The two intensities used in these tests were, approximately, 4.8 inches per hour for the high intensity and 2.4 inches per hour for the low intensity.

"The advanced-type rain used in these tests was obtained by applying the high intensity for 10 minutes and the low intensity for 40 minutes. And, likewise, the delayed-type rain was obtained by applying the low intensity for 40 minutes and the high intensity for 10 minutes. These two intensities, for their specified lengths of time, give a total rain of 2.40 inches."

Hydrologic Studies - T. W. Edminster, Blacksburg, Va.-"During the week of the 11th, Mr. Lillard, Experiment Station Project Leader, Mr. Holtan, the Project Supervisor, Mr. Glenn Wilson, Survey Supervisor, and Mr. John Kane, Soil Surveyor, visited the former Army Remount Station at Front Royal and the Northern Piedmont Pasture Experiment Station at Middleburg, Va., for the purpose of investigating the possibility of hydrologic studies on those areas. Conferences were held with Dr. C. M. Kincaid and Dr. Baker, who are project leaders at the Front Royal Station, and Dr. Roy Blaser and Dr. W. H. Skrdla, project leaders on the Middleburg Station. On the initial investigation, it appeared that the Middleburg farm would be admirably suited for studying a series of subdivided watersheds ranging from 5 to 200 acres in area. In all probability, it will take some months to work out necessary operating arrangements with these stations before any definite plans can be established.

"Messrs. Holtan and Kirkpatrick have continued their analyses of the Chatham data. They report that 'present thinking at this project is that in order to predict or estimate runoff phenomena involved must be isolated and understood individually before a prediction can be made of the end result.

'In line with this, present analyses are based on studying hydrology in three phases: rainfall, infiltration, and hydraulics of flows. Estimates of rainfall for various frequencies are generally obtainable. Infiltration can be estimated for at least rather broad groups of vegetative cover and soils. Hydraulics should follow the same laws, regardless of the location, universally. They are based on physical characteristics only; therefore, the scope of application as well as the data from which information can be drawn is greatly broadened. At the present writing, the hydraulics of flow is expressed in one curve; depth vs. discharge rate. Curves are on hand for watersheds ranging in size up to 50 acres and varying in conditions from clean tilled-straight row, contoured strips, terraced clean cultivated, and clean channels through terraced with weeds and rank growth in channels. This implies the coverage expected for the application of results. The next step is to obtain infiltration estimates for these same conditions on varying soils.'"

A correction should be made in the quotation in the Research Summaries for the month of August. The quotation appeared on page 17, paragraph 2, lines 5 and 6, as follows: "They imply that more information concerning the hydrograph lies in instantaneous peak rates." The correct quotation should read: "They imply that more information concerning the hydrograph lies in increments of mass runoff than lies in instantaneous peak rates.

Supplemental Irrigation Studies - J. R. Carreker, Athens, Georgia.-"Rainfall was well distributed during October with precipitation measured as follows: October 5, 0.31 inch; 7, 0.39 inch; 15-16, 0.55 inch; 25-28, 0.94 inch; and 29-30, 0.60 inch. The total rainfall was 2.79 inches as compared with the normal of 2.91 inches. Evaporation from the pan amount to 2.71 inches. Total wind movement was 581.4 miles. Temperatures were mild throughout the month.

"Harvesting corn on Blocks I, II, III and V-II was completed in October. Only the Block IV corn remained to be harvested.

"The fertilizer applied to the corn on all blocks included uniform quantities of phosphate and potash and variable amounts of nitrate. A broadcast application of 1,000 lb/ac 0-12.6-7.5 prior to planting and a band application of 400 lb/ac 4-8-6 in the row at planting provided 16, 158, and 0.99 lb/ac of N, P_2O_5 and K_2O, respectively. Variations in the nitrate side dressing, the irrigation practices and the yield records on the different blocks are given below:

"Block I: Sprinkler irrigation vs none with 125, 250, and 500 lb/ac. 33 percent ammonium nitrate side dressing on June 3. Corn was planted April 25. The corn yields with these three nitrate levels with and without irrigation were:

Fertilizer Applied N-P_2O_5-K_2O lb/acre	Corn Yield		
	Unirrigated	Irrigated	Difference
	Bushels per acre		
57.2-158-99	71.9	79.0	7.1
98.5-158-99	80.3	80.9	.6
181.0-158-99	82.3	85.6	3.3

"Block II: Sprinkler irrigation vs none on late planted (May 24-26) corn. All plots were side dressed with 250 lb/ac 33 percent ammonium nitrate giving total applications of 98.5-158-99 lb/ac of N-P_2O_5-K_2O, respectively. The yields from this late planted corn were:

Irrigated - 66.1 bu/ac
Unirrigated - 64.5 bu/ac
Difference - 1.6 bu/ac

"Block III: Sprinkler irrigation with 3 liquid nitrate fertilizers applied at the rate of 176 lb/ac N through the irrigation system on June 14-15 to corn that was planted May 6. The total fertilizer applied was 192-158-99 lb/ac N-P_2O_5 - K_2O respectively. These materials, with corresponding corn yields were:

Anhydrous Ammonia	77.6 bu/ac
Barrett's solution 4	85.0 bu/ac
Barrett's solution 32	100.0 bu/ac

"Block V-II: Furrow irrigation vs none with 500 lb/ac 33 percent ammonium nitrate side dressing vs furrow irrigation with Barrett's solution 32 nitrate side dressing applied in the irrigation water. The dry fertilizer gave a total nitrate application of 181 lb/ac N while the liquid material provided 185 lb/ac N. All treatments received 158 and 99 lb/ac P_2O_5 and K_2O, respectively. A large growth of green vetch and oats was turned into this soil in the early spring. The yields from these treatments were:"

Treatment	Measured Plants/ac No.	Measured Yield Bu/ac	Corrected Plants/ac No.	Corrected Yield Bu/ac
Furrow irrigation Liquid fertilizer	13,000	130.3	13,000	130.3
Furrow irrigation dry fertilizer	11,923	113.7	13,000	123.9
No irrigation dry fertilizer	11,774	103.6	13,000	114.3

Muck Drainage Experiments, R. B. Hickok, Walkerton, Indiana.-"Subsidence measurements were made on the experimental drainage plots on the Purdue Muck Experiment Farm, and on four subsidence courses on muck fields in commercial operation.

"The following subsidence was found for the past year at the Experiment Farm on plots with varying depths of drainage:

Water Table Depth	Annual Subsidence Rate
15 inches	0.036 ft/yr
24	.058
30	.070
40-42	.101

"The above values are almost exactly coincident with the 5-year averages indicating that the results to date are conclusive for these plots under their present system of management. There is indicated a straight line relationship between the depth of drainage and the rate of subsidence.

$$X = \frac{Y - 0.41}{27.41}$$

When: X = Subsidence Rate in feet per year, and
Y = Depth of Drainage in feet
(Correlation coefficient = 0.9178)

"Measurements on commercial tracts for the period 1943-49 show average subsidence rates for eight (8) courses ranging from about 0.06 to about 0.16 foot per year, with extremes between 0.04 and 0.20 for particular 500-foot sections. Mr. Jongedyk states that the data and observations indicate the highest rates of subsidence in the areas of deepest muck and in locations with highest surface elevations (probably deeper zones of drainage) within a particular area."

Drainage Studies - E. G. Diseker, Raleigh, N. C.-"In connection with the Plymouth Experiment, considerable trouble has occurred with acquatic plants in the McRae Canal at Plymouth. This is fairly common occurrence in most drainage or irrigation ditches. In some instances the plants have impounded the water to the extent that silt deposits plus or minus 1 foot in height, have been found in the bottom of the canal. Samples of nine of the plants, which caused the trouble, were collected by the writer and turned over to the Botany Department of N. C. State College for identification and recommendations for control.

"All available literature on the subject of controlling these plants was reviewed. As a result, and also due to recommendations by a member of the Botany Department, one pound of sodium arsenite and 1/2 pound of sodium chlorate per gallon of water was applied as a spray to the vegetation, beginning at the south end of Plot E. It required 2 gallons of this solution to cover 510 linear feet of the canal which had a 12-foot bottom width. The solution was applied from the south end of the plot and extended north. The writer also decided to dump some of the solution into the canal at the north end of Plot E, a distance of 1,320 feet from the upper end of the sprayed area, and also about 300 feet to the north of Plot C. One gallon was dumped into the canal at each of the two latter locations. The velocity of the water was 6 feet per minute. All the poison was applied on Thursday, October 27, 1949, at 1:00 o'clock p. m. It rained on October 28, at 6:00 p. m., and continued raining for several days until the total precipitation reached 5 inches. A check of the result was made on October 10, at which time a rapid flow of water was still present in the canal. The check showed that only about 15 percent of the upper part of the plants was dead as a result of the spraying, and only 5 percent of the plants were damaged, at a distance of 300 feet below where the poison was dumped into the canal."

Drainage Studies - T. W. Edminster, Blacksburg, Va.-"A manuscript entitled 'Drainage in Conservation Farming' was completed and cleared for presentation on a panel discussion of water-control problems at the Soil Conservation Society Annual Meeting in St. Louis on November 10, 11, and 12.

"Mr. Walker makes the following report with regard to the engineering studies:

'It was noted in the Project's August 1949 report that the 6-inch tile main on the S. W. Lee farm, Holland, Va., contained 4-1/2 inches of sedimentary material. Then, since the soils on the Lee farm and the J. E. Rawls farm appear comparable, it was decided that more detailed observations should be made on the Rawls farm. Heavy rainfall prevented the making of these observations during September.

'This tile system was installed in March 1947 which was about a month prior to the installation date of that on the Lee farm. The tile was of unglazed clay. It was, however, much better formed tile than that used on the Lee farm. A 'draw-hole' over one lateral was repaired April 7, 1949. At that time there was no appreciable amount of sedimentary material in the tile line. In other words, only the usual amount of sediment was present.

'The tile main and one lateral were opened for inspection. (Mr. Rawls furnished labor for digging which amounted to 4 hours. Labor for more digging was not available.) An effort was made to open both main and lateral in localities most likely for sediment to accumulate. It was believed that these localities were those areas where tile was definitely located in the sand layer and receiving a large amount of water from the surrounding soil. The first four laterals from the east edge of the field were believed to meet these conditions. Therefore, the main was opened between the fourth and fifth lateral. The fourth lateral was opened beside and just below a sag in the ground surface where water had been ponding.

'No unusual amount of sediment was noted in either main or lateral (almost none in lateral and less than 1/2 inch in main). Again, and in both instances, it was easy to feel the print of the trenching machine shoe in the floor of the ditch. Tile was placed close together forming tight connections between joints of tile. In fact, it was necessary to break a tile joint in order to get into the lateral.

'There may be some question as to the draining efficiency of this system. Mr. E. T. Batten, Superintendent, Tidewater Field Station, Holland, Va., said that there were "many indications of poor drainage." Mr. Rawls indicated that he expected both yield and quality of peanuts to be poor. On the other hand, this field has been always one of his low producing fields. At the same time, the time and amounts of rainfall may have been one of the largest factors in peanut yields this year.'"

Drainage Studies - J. C. Stephens, West Palm Beach, Fla.-"For a calendar year period the maximum 24- and 48-hour rainfall rates to be expected at Belle Glade, Fla., are tabulated below together with the difference in the two rates. It is significant that the same rainstorms were effective in producing both the 24- and 48-hour peak rates in 24 years out of the 26.

Recurrence interval (1 in.)	24-hr.	(Calendar year) max. expected rainfall in 48-hr. period	48 hr -24 hr. inches	Percent difference 48 to 24-hr.
2 yrs.	4.49	5.21 inches	0.72	116
5 "	6.48	7.29 "	.81	112
10 "	7.71	8.77 "	1.06	114
25 "	9.51	10.47 "	.96	110
50 "	10.69	11.73 "	1.04	110

"For the 5-month period - November through March - which is the growing season for many of the truck crops raised in this area, the probable maximum rainfall in 24 and 48 hours was found to be:

Recurrence interval (1 yr. in:)	24 hrs.	(Nov. through Mar.) Max. expected rainfall in 48-hour period	48 hrs. -24 hrs. inches	Percent. difference 48 to 24 hrs.
2 yrs.	2.30	2.52 inches	0.22	110
5 "	4.56	4.92 "	.36	108
10 "	5.96	6.29 "	.33	106
25 "	7.88	8.29 "	.41	105
50 "	9.29	9.67 "	.38	104

"A formula was developed in an effort to determine the relative effectiveness of different drainage rates in removing water from within any critical zone near the soil surface under assumed storm rainfall rates and initial water levels at the beginning of the storm. This formula is:

$$T = \frac{F}{R(i-c)} + \frac{BR(i-c) - D}{R(i-c)} + \frac{BR(i-c)-d}{Rc} + \frac{F}{Rc}$$

where:

T = Time, in hours, that water level in ground will be above critical depth "F."
F = Critical depth, in inches, below average ground surface, above which water will kill or damage crop within a critical time period.
R = Ratio of soil voids to soil material, or ratio of water rise or fall in soil to rise or fall of free water.
P = Total storm rainfall in inches.
B = Length of storm rainfall in hours.
i = P/B (average hourly intensity of rainfall).
c = Average water removal rate of drainage system in inches per hour.
D = Depth of water table, in inches, below average ground surface at the beginning of storm.

"For example, assume in the peat soils of the Everglades it is desired to find the time "T" that water will remain within an assumed critical depth "F" of 6 inches where the initial depth of water below ground surface is 20 inches at beginning of storm using the recurrence interval of 1 year in 5 for a 24-hour storm period. Then:

F = 6 inches
R = 6 (ratio determined by tests for peat soils of 'Glades)
P = 6.48 inches (from frequency table listed above)
B = 24 hours " " " " "
i = 6.48/24 = 0.2700 inches/hr.
D = 20 inches

"To compute "T" for drainage system with "c" of 1 inch in 24 hours, or c = 1/24 = 0.0417 inch per hour. By substitution:

$$T = \frac{6}{6(.2700 - .0417)} + \frac{24 \times 6(.2700-.0417)-20}{6(.2700 - .0417)} + \frac{24 \times 6(.2700-.0417)-20}{6 \times .0417} + \frac{6}{6 \times .0417}$$

$$T = 4.4 + 9.4 + 51.5 + 24.0 = 89.3 \text{ hrs.}$$

"If the capacity of the drainage system to remove water is doubled and c = 2/24 or 0.0833 inch/hr., then:

$$T = \frac{6}{6(.2700-.0833)} + \frac{24 \times 6(.2700-.0833)-20}{6(.2700-.0833)} + \frac{24 \times 6(.2700-.0833)-20}{6 \times .0833} + \frac{6}{6 \times .0833}$$

$$T = 5.4 + 6.1 + 13.8 + 12 = 37.3 \text{ hours.}$$

"In this formula the first term gives the time required for the water to rise through the critical zone immediately below average ground surface during the storm; the second term gives the time the water will rise above ground level to a peak at the end of the storm; the third term shows time required for the water to fall from its peak at the end of the storm to average ground level; and the fourth term the time required to fall in the soil to below the critical level. Thus, the time water will remain ponded above average ground surface can be obtained by adding the second and third terms.

"Considerable investigation remains to determine the time tolerance of different crops in this area to high water levels at, or near, ground surface, before any formula, such as the above, can be of service other than a general guide in establishing criteria for the design of drainage works.

"Considerable time during the past month was spent on hydrologic computations at the request of the Central and Southern Florida Flood Control District. We were assisted in this work by Mr. Jim Clawson of the Florida State Board of Water Surveys and Research who spent several weeks in the Soil Conservation Service office in West Palm Beach. One of the main problems was the establishment of a method of determining water losses used in computing water available for storage in the proposed conservation areas in the southern part of the District. A brief outline of the method adopted by the District follows:

"The principal assumptions made in computing water losses used in estimating the amount of water to be available for storage in the conservation areas proposed for the flood control district were:

1. That water losses in the conservation areas will be comparable to losses presently occurring in the Southeastern Everglades during an extremely wet year, when water is present almost continuously to supply the demands of evaporation and transpiration.

2. That losses in the agricultural and other contributing areas will be comparable to those occurring during an average year under present conditions.

3. That losses will be greater during a dry year and an average year than during a wet year if water is available to supply the evaporation demand. This is believed true because of fewer cloudy and rainy days and consequently more sunshine and lower humidity.

"The year 1947 was a period of extremely high rainfall. An examination of the records showed that the basin storage differential between March 1, 1947, and February 29, 1948, was negligible, and that period rather than the calendar year was used to compute wet year water losses, in order to obviate the necessity of estimation and deducting storage from the apparent water losses.

"Monthly water losses were then computed by prorating the total losses for the March 1, 1947, to February 29, 1948, period, as recorded by the USGS, to months in accordance with measured evaporation.

"For this purpose an average of the mean monthly records from a standard land pan and an experimental tank, planted in saw grass, was used. Losses for any given month would then equal:

$$\left(\frac{\text{Monthly (land pan + Sawgrass)}}{2} \div \frac{\text{Annual (L.P. + S. G.)}}{2}\right) \times \text{total annual water losse}$$

"This provided a table of monthly water losses for a wet year believed to be comparable to losses that will occur annually in the proposed conservation areas, when modified by application of a sunshine factor.

"Therefore, water losses used in computing the quantity of water expected to be available for storage in the conservation areas are as shown in table 1.

"Column 1 of this table shows the estimated water losses by months in the conservation areas for a wet year. These are the losses, without modification, computed from the measured losses for the year March 1, 1947, to February 29, 1948.

"Column 2 shows the losses estimated for the conservation areas for an average year. They are losses in column 1 increased by the sunshine factor, average annual evaporation / evaporation for wet year.

"Column 3 shows the losses in the conservation areas estimated for a dry year. They are the losses in column 1 increased by the sunshine factor, evaporation for dry year / evaporation for wet year.

"Column 4 shows estimated losses for the contributing areas for an average year, which are the average annual measured losses for the Southeastern Everglades area, prorated to calendar months according to the average of land pan and sawgrass tank evaporation data.

"Column 5 shows estimated losses for the contributing areas for a wet year, which are the losses in column 4 modified by the sunshine factor, wet year evaporation / average annual evaporation.

"Column 6 shows estimated losses for a dry year which are those of column 4 modified by the sunshine factor, evaporation for the dry year / average annual evaporation.

"Additional seepage losses which result from increased heads in the proposed conservation areas have not been taken into account in the table of results. Calculations of these losses are extremely difficult from data available. However, evidence points to the fact that the magnitude of seepage losses in the southernmost areas will be large, and may well be a determining factor in the success or failure of the plan."

Table 1.--Extimated water losses for the Central and Southern Flood Control District

	Conservation areas			Contributing areas		
	Wet year losses (inches)	Average year losses (inches) (Col. 1x1.08)	Dry year losses (inches) (Col. 1x1.14)	Average year losses (inches)	Wet year losses (inches) (Col. 4x0.92	Dry year losses (inches) (Col. 4x1.05)
	(1)	(2)	(3)	(4)	(5)	(6)
January	2.68	2.89	3.06	2.31	2.12	2.42
February	2.82	3.04	3.21	2.44	2.24	2.56
March	3.90	4.21	4.45	3.38	3.11	3.55
April	4.74	5.12	5.40	4.11	3.78	4.32
May	5.74	6.20	6.54	4.97	4.57	5.22
June	5.18	5.60	5.90	4.50	4.14	4.72
July	5.54	5.98	6.32	4.80	4.42	5.04
August	5.09	5.50	5.80	4.42	4.07	4.64
September	4.35	4.70	4.96	3.77	3.47	3.96
October	4.15	4.48	4.73	3.60	3.31	3.78
November	2.87	3.10	3.27	2.49	2.29	2.61
December	2.37	2.56	2.70	2.06	1.90	2.16
	49.43	53.38	56.34	42.85	39.42	44.98

Drainage Studies - M. H. Gallatin, Homestead, Fla.-"Rainfall for the period for the area averaged from 8.85 to 13.61 inches. Rains occurred during October 1 to October 13, light showers from October 2, to 24, and heavy rains from October 25 to 31. On October 10 rains of 1 to 4 inches were recorded. On October 25 rains 4 to 8 inches were recorded on our gages.

"The heaviest showers during the early part of the period occurred in the north and western part of the area, and the rains of October 25 were heaviest in the southern part of the area with somewhat lighter showers in the north, west, and eastern portion of the area

"Readings made in the mulch plots during this period showed that for the natural cover and check areas, though we had approximately 4 inches of rain on October 10, on October 21, the moisture content was close to wilting. On the mulched areas little or no difference in the readings were recorded.

"Analysis of samples for nitrification and nitrate losses showed that all available nitrates were lost from all of the areas. Samples collected at the end of the period showed that with good moisture relation we had an increase in nitrates in the grass and pine straw mulch areas.

"During the past period we have had the opportunity to check on the rate of leaching of cyanamid. Cyanmid was applied to one grove on October 10, following this we had a rain of 4 inches. We found on later sampling that we had lost little or no nitrogen other than the portion readily available. Then on October 25 we had another rain of about 5 inches in this area, about the end of the breakdown period. Sampling just prior to this rain showed about 200 P.P.M. of nitrate nitrogen. Sampling immediately following the shower showed we had lost practically all of this readily available material. Samples collected the following week showed that there was enough reserve material to bring it back up. Analysis of samples collected over this period are presented below:

Date	Middle of the row	Canopy of tree	
10/3/49	21.5	27.5	
10/10/49	48.0	49.0	(4-inch rain)
10/17/49	69.0	92.6	
10/24/49	122.0	199.0	
10/25/49	25.2	60.5	(4-5 in. rain)
11/1/49	29.6	126.0	
11/7/49	43.4	106.0	

"From the above it will be noted that Cyanamid does not leach too readily. Samples analyzed where Cynamid had been applied to our marl soil follow this same general trend."

DIVISION OF IRRIGATION AND WATER CONSERVATION

West Coast Basin, Los Angeles: C. Marvin Litz, Los Angeles, California.- "In the process of final revision of the West Coast Basin Report, it was found advisable to recalculate consumptive use of water by the various land-use classifications. In the revised report, the period 1922-43 has been used. Annual consumptive use has been computed for each year of the 22-year period. The calculations are based upon the Blaney-Criddle method, using mean temperatures and the percent of daytime hours. It is of interest to note that the deviation between the 22-year mean consumptive use and the individual yearly consumptive use on irrigation crops is not great. The range in mean annual temperatures is from 61.1 to 65.9 degress Fahrenheit and the range in consumptive use from 25.2 to 27.4 inches on truck crops and from 37.8 inches to 40.9 inches on grass and lawns.

Soil Permeability Studies, Soil Conservation Districts - V. S. Aronovici, Pomona, California.-"Late in October, a series of soil permeability samples were secured in the San Fernando Valley and several locations in the Antelope Valley Soil Conservation Districts. A series of comparative permeability samples were taken in alfalfa fields where so-called, 'hard spots' or 'slick spots' occurred, and adjacent to them in areas of good production. In addition to permeability observations, tests were made of conductivity and sodium concentration of 1:1 soil solution extracts.

"With the exception of the 2M soil, differences in permeability are negligible. Such is also the case of all other factors measured. From these observations, it appears that some other factor or factors contribute to the differential productivity. It is suggested that inequitable irrigation water distribution caused by imperfect leveling may be a major factor contributing to this condition."

San Fernando Valley Drainage Investigations - W. W. Donnan, Los Angeles, California.-"Two more sets of soil samples have been secured from truck crop fields to complete the consumptive use measurements for the summer irrigation season. It was found that truck crops had an average consumptive use of 1.5 inches in May, 2.0 inches in June, 2.2 inches in July, 2.1 inches in August, 1.5 inches in September, and 1.3 inches in October. The total consumptive use for the summer irrigation season was 10.7 inches. The fields being sampled were squash fields on a medium soil."

Imperial Valley Drainage Investigations - W. W. Donnan, Los Angeles, California.-"One of the most unique soil formations to be found in Imperial Valley occurs in the northeast portion of the irrigated area. Along the eastern edge of the valley area, the soils are underlain with long transverse clay dikes. These dikes were probably formed as off-shore clay bars at the time the area was a part of the old prehistoric Salton Sea. They have since been overlain with out-wash from the higher areas and with wind blown sands. These areas present a distinct drainage problem, since the clay dikes are found to be at right angles to the normal ground slope and underground seepage flow.

"A procedure has been worked out for designing tile drainage systems in these areas. It has been found that the most important single factor is the position of the tile lines with respect to the barrier. Excess seepage and irrigation water originating up-slope from the barrier tends to build up at the barrier, causing a water table. The tile system is designed so that the initial line is placed as close as possible to the upstream face of the clay barrier and parallel to it. Additional lines up-slope from the key lateral are placed at a spacing dependent

upon soil permeability. Field studies on several tiled parcels of land indicate that the most successful tile systems are those where the tile lines are located with respect to these barriers."

Water Requirements in the Southwest - Harry F. Blaney, Los Angeles, California.-"In connection with the report being prepared on water requirements, an analysis was made of measured consumptive use, temperature, and precipitation in several irrigated areas in Arizona, California, Colorado, and Oklahoma. Several crops such as alfalfa, cotton, and citrus were included in the study. The following tabulation illustrates the method of computing normal monthly consuptive use and irrigation requirements for orange trees at Santa Ana, Calif., based on field observations.

Month	Mean temperature (t)	Daytime hours (p)	Consumptive use factor (f)	Average rainfall (r)	Consumptive use (u)	Consumptive use minus rainfall (u-r)	Irrigation requirement 1/ (i)
	°F	Percent		Inches	Inches	Inches	Inches
Apr.	59.9	8.79	5.26	0.98	2.63	1.65	2.1
May	63.5	9.71	6.17	.38	3.08	2.70	3.4
June	67.1	9.69	6.50	.04	3.25	3.21	4.0
July	71.4	9.87	7.05	.01	3.52	3.51	4.4
Aug.	71.9	9.33	6.71	.05	3.35	3.30	4.1
Sept.	69.5	8.36	5.81	.22	2.90	2.68	3.3
Oct.	64.7	7.90	5.11	.71	2.55	1.84	2.3

1/Based on irrigation efficiency of 80 percent under good irrigation practice in Orange County. Usually in normal and wet years 2 to 4 inches of moisture is available as carry-over from winter rains. Under such conditions, this moisture should be deducted from irrigation requirements.

$u = kf = 0.50\ f$ = monthly consumptive use for organge trees
$k = 0.50$ - monthly consumptive use coefficient for orange trees
$i = \frac{u-4}{0.80}$ = monthly irrigation requirement

"In connection with the use of water study in the lower Colorado River Basin, areas of irrigated land and riparian vegetation along the river in Arizona and California below Boulder Canyon, were inspected. There are large areas of riparian or natural vegetation along the river, such as salt cedar, cottonwoods, willows, and tules, which use a tremendous amount of water. Evaporation and evapo-transpiration losses along the river from Hoover Dam to Yuma have been estimated as high as 1,000,000 acre-feet per year by some engineers.

Irrigation Studies - I. D. Wood, Denver, Colorado.-"The results of the corn yield trials on the Erling German farm at Cozad and the Lestern Stibor farm at Shelton were made public at these two meetings. The purpose of the test was to discover what hybrid varieties of corn would give the best yield under high application rates of commercial fertilizers plus heavy water applications.

"All phases of corn culture including irrigation were discussed and the means by which yields of almost 160 bushels of corn were obtained were described in detail."

"Fourteen corn plots were husked at each farm. I discussed the various means of applying water to corn and the amount of water used in growing an average corn crop in the Platte Valley.

"Everett Mitchell of the National Broadcasting Company Farm and Home Hour asked me to make several recordings for his Great Stories on Corn which will be broadcast over the National Farm and Home Hour on National Broadcasting Company stations in the near future.

"Spent a day meeting with the committee on irrigation development in Kansas. The particular subject under discussion was the location of several experimental farms in newly irrigated areas. At least 2 tentative locations were decided upon and the Bureau of Reclamation who will finance most of the undertaking were agreeable to the locations selected. Topographic maps of the farms were presented and the fact brought out that well irrigation would be necessary since gravity water will not be available for a couple of years.

"The committee on which I am serving will be charged with the responsibility of the irrigation lay-out, the types of irrigation to be practiced, and the methods of applying irrigation water.

Irrigation Studies - J. S. James, Billings, Montana.-"At the request of the District Conservationist, the Hardin Drainage Report was presented to the Supervisors of the Big Horn Soil Conservation District and to a public meeting. Work was continued on Survey Reports for five other drainage projects."

Irrigation Studies - D. W. Bloodgood, Austin, Texas.-"During the month our Progress Report No. 10 on Silt Load of Texas Streams (1947-1948) was multilithed, and most of the first edition (approximately 300 copies) was exhausted within a short time. A second edition (300 copies) of the report was also multilithed during the month. Of the 163 form letters mailed out to individuals and agencies interested in silt of streams, 85 letters were received requesting one or more copies. Of the 300 copies of the first edition, 276 copies were sent out upon request. One request was for 100 copies for the East Texas Chamber of Commerce, Longview, Texas. Other requests for this report and for complete sets of the series of silt reports are being received daily. The report is available and free upon request

Irrigation Studies - B. R. Tomlinson, Laramie, Wyoming.-"There has been quite a bit of controversy between different factions in the State on whether or not the mountain meadows have been decreasing in yield. Therefore, the production produced on a 112-acre meadow adjoining the experimental plots was measured and by using the U.S.D.A. formula ((.52 x overthrow) - (.46 x width)) Width x Length = cubic feet of hay, and for wild hay 30-90 days settled = 600 cubic feet per ton calculated from a total of nine stacks, a total production of 96.02 tons or .86 of a ton/acre. The following yields were obtained by the Wyoming and U. S. Departments of Agriculture for Sublette County:

1931	0.50 ton/acre	1940	0.86 ton/acre
1932	1.00 "	1941	1.09 "
1933	0.60 "	1942	0.89 "
1934	0.49 "	1944	0.89 "
1935	0.95 "	1945	0.90 "
1939	0.88 "	1946	0.97 "

"During this 3-year period (1944-46) there was also a 10,200-acre decrease in the number of acres harvested in this county.

"Although the above figures are estimates, it is hoped that some definite information can be obtained by checking this area from year to year and determining the trend of the mountain meadows."

12/12/49